

WHAT IS CLAIMED IS:

1. A method for forming an aperture plate, the method comprising:  
providing a mandrel comprising a plate body having a conductive surface  
and a plurality of non-conductive islands disposed on the conductive surface, wherein the  
islands extend above the conductive surface and are sloped relative to the conductive  
surface;

placing the mandrel within a solution containing a material that is to be  
deposited onto the mandrel;

applying electrical current to the mandrel to form an aperture plate on the  
mandrel, wherein the apertures have an exit angle that is in the range from about 30° to  
about 60°.

2. A method as in claim 1, wherein the islands have a geometry that  
approaches a generally conical shape, and wherein the islands have a base diameter in the  
range from about 20 microns to about 200 microns and a height in the range from about 4  
microns to about 20 microns.

3. A method as in claim 1, wherein the islands have an average slope  
in the range from about 15° to about 30° relative to the conductive surface.

4. A method as in claim 3, further comprising forming the islands  
from a photoresist material using a photolithography process.

5. A method as in claim 4, further comprising treating the islands  
following the photolithography process to alter the shape of the islands.

6. A method as in claim 1, further comprising removing the deposited  
aperture plate from the mandrel and forming a dome shape in the aperture plate.

7. A method as in claim 1, wherein the material in the solution is  
selected from a group of materials consisting of palladium, palladium nickel, and  
palladium alloys.

8. A method as in claim 1, wherein the apertures have an exit angle  
that is in the range from about 41° to about 49°.

9. An aperture plate formed according to the process of claim 1.

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1 19. A method for producing a mandrel that is adapted to form an  
2 aperture plate, the method comprising:  
3 a) providing an electroforming mandrel body;  
4 b) applying a photoresist film to the mandrel body;  
5 c) placing a mask having a pattern of circular regions over the photoresist  
6 film;  
7 d) developing the photoresist film to form an arrangement of non-  
8 conductive islands corresponding to the location of the holes in the pattern; and  
9 e) heating the mandrel body to permit the islands to melt and flow into a  
10 desired shape.

1 20. A method as in claim 19, further comprising repeating steps b)  
2 through e) where the pattern of circular regions of the mask are smaller.

1 21. A method as in claim 20, wherein the desired shape is generally  
2 conical.

1 22. A method as in claim 20, further comprising permitting the islands  
2 to cure before repeating the steps.

1 23. A method as in claim 20, further comprising heating the mandrel  
2 body until the islands have an average angle of taper that is in the range from about 15° to  
3 about 30°.

1 24. A method as in claim 19, wherein the photoresist film has a  
2 thickness in the range from about 4 microns to about 15 microns.

1 25. A method as in claim 19, wherein the mandrel body is heated to a  
2 temperature in the range from about 50°C to about 250° C for about 30 minutes.

1 26. A method as in claim 25, further comprising raising the  
2 temperature at a rate that is less than about 3°C per minute until reaching the desired  
3 range.

1 27. A method for aerosolizing a liquid, the method comprising:



33. An aperture plate as in claim 32, wherein the lower portion has a diameter at the lower surface that is in the range from about 20 microns to about 200 microns, a height in the range from about 4 microns to about 20 microns.

34. An aperture plate as in claim 31, wherein the bottom surface is adapted to receive a liquid, and wherein the plate body is vibratable to eject liquid droplets from the front surface.

35. A method for ejecting droplets of liquid, the method comprising:  
 providing an aperture plate comprising a plate body having a top surface, a bottom surface, and a plurality of apertures that taper in a direction from the top surface to the bottom surface, wherein the apertures have an exit angle that is in the range from about 30° to about 60°, and a diameter that is in the range from about 1 micron to about 10 microns at the narrowest portion of the taper; and  
 forcing liquid through the apertures to eject liquid droplets from the front surface.

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